

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

- 1 1. (Previously presented): An allocation method for a storage area of a
2 storage device to a virtual volume in a storage system having a plurality of virtualization
3 apparatuses that allocate the storage area which the storage device has, form a plurality of virtual
4 volumes, and process input-output from a host processor to one of the virtual volumes,
5 comprising the steps of:
6 issuing, to the plurality of virtualization apparatuses, a request for completing all
7 input-output requests received from the host processors that are being processed by the
8 virtualization apparatuses and temporarily holding any subsequent input-output requests received
9 from the host processors;
10 receiving, from the plurality of virtualization apparatuses, a completion report of
11 the input-output requests being processed by the virtualization apparatuses in response to the
12 request for completing;
13 sending an instruction of an allocation change of the storage area of the storage
14 device to all the virtualization apparatuses upon receiving completion reports from all the
15 virtualization apparatuses to which the request for completing was issued;
16 receiving a completion report of the allocation change from all the virtualization
17 apparatuses; and
18 sending an instruction to all the virtualization apparatuses for releasing the input-
19 output request that are being temporarily held,
20 wherein a virtualization apparatus that did not send its completion report is
21 removed from a control range and the allocation of its storage area is not changed.

1 2. (Previously presented): An allocation method according to claim 1,
2 wherein a table storing configuration information that associates the virtual volume with the
3 storage area that becomes a real area of the storage device is prepared in a memory in advance,
4 and
5 when the instruction of an allocation change of the storage area is sent, difference
6 information of the configuration information is sent, and the virtualization apparatus changes the
7 configuration information on a relevant entry of the table.

3. (Canceled)

1 4. (Previously presented): An allocation method according to claim 1,
2 wherein whether a subsequently received input-output request is held temporarily or not is
3 controlled aiming at an address range including a location where the allocation is changed on the
4 virtual volume.

1 5. (Previously presented): An allocation method according to claim 1,
2 further comprising, for a virtual volume with newly allocated storage area, copying data from
3 storage area previously allocated to the virtual volume to the newly allocated storage area.

1 6. (Previously presented): A storage system, comprising:
2 a storage device that can specify a plurality of storage areas;
3 a plurality of virtualization apparatuses that allocate the storage area to form a
4 plurality of virtual volumes, and to process input-output requests sent from a plurality of host
5 processors to one of the virtual volumes; and
6 a configuration change controller for changing an allocation configuration of the
7 storage area to the virtual volumes, wherein
8 the configuration change controller includes:
9 means for requesting temporary hold of input-output requests to the virtualization
10 apparatuses,

11 the virtualization apparatus that received the request includes:
12 means for completing all input-output requests received from the host processors
13 that are being processed by the virtualization apparatus, shifting to a state of temporarily holding
14 subsequently received input-output request from the host processors, and returning a completion
15 report of processing of the input-output requests to the configuration change controller, and
16 the configuration change controller includes:
17 means for instructing an allocation change of the storage area to the virtual
18 volume to the virtualization apparatus when receiving the completion report from all the
19 virtualization apparatuses to which a request was issued,
20 wherein a virtualization apparatus that did not send its completion report of the
21 input-output processing is removed from a control range and the allocation of its storage area is
22 not changed.

1 7. (Previously presented): A storage system according to claim 6, wherein
2 the configuration change controller includes:
3 a configuration change control program that includes the request means, means
4 for receiving the completion report from the virtualization apparatus, and the change instruction
5 means;
6 a processor that executes the configuration change control program;
7 a memory that stores a configuration information table registering configuration
8 information that associates the virtual volume with the storage area that becomes a real area of
9 the storage device and a difference information table recording a difference before and after the
10 change of the configuration information,
11 the virtualization apparatus, includes:
12 a configuration management program that performs processing of a configuration
13 change;
14 a processor that executes the configuration management program; and
15 a memory that stores a configuration information table registering the
16 configuration information that associates the virtual volume with the storage area that becomes

17 the real area of the storage device and a difference information table recording the difference
18 before and after the change of the configuration information, and
19 the configuration change controller sends the difference information of the
20 configuration information to the virtualization apparatus with reference to the difference
21 information table when sending the instruction of the allocation change of the storage area, and
22 the virtualization apparatus executes the configuration management program by the processor
23 and changes the configuration information of a relevant entry of its own the configuration
24 information table in accordance with the received difference information.

1 8. (Original): A storage system according to claim 6, further including a
2 management console comprised of an input unit that inputs a request of the change of the
3 configuration information to the configuration change controller and a display unit that displays
4 a status of the configuration change.

1 9. (Previously presented): A virtualization apparatus that allocates a storage
2 area of a storage device, forms a plurality of virtual volumes from the storage area and processes
3 input-output request sent from a plurality of host processors to one of the virtual volumes,
4 comprising:
5 a configuration change control program for changing a configuration of
6 associating the virtual volume with the storage area that becomes a real area of the storage
7 device; and
8 a first processor that executes the configuration change control program, wherein
9 the program includes:
10 means for requesting an input-output request temporary hold to a first
11 virtualization apparatus before changing the configuration of associating the virtual volume with
12 the storage area that becomes the real area of the storage device;
13 means for allowing the first virtualization apparatus that received the request to
14 complete all input-output requests received from that host processors that are being processed,

shifting to a state of temporarily holding subsequently received input-output requests from the host processors, and returning a completion report;

means for instructing, to the first virtualization apparatus, an allocation change of the storage area to the virtual volume when receiving the completion report from the first virtualization apparatus;

means for receiving the completion report of the allocation change from the first virtualization apparatus; and

means for sending an instruction to the first virtualization apparatus for releasing the input-output request that are being temporarily held,

wherein if the first virtualization apparatus does not send the completion report of the input-output processing, then the first virtualization apparatus is removed from a control range and the allocation of its storage area is not changed.

10. (Previously presented): A virtualization apparatus according to claim 9, further comprising:

a memory storing a configuration information table registering configuration information that associates the virtual volume with the storage area that becomes the real area of the storage device and a difference information table that records a difference before and after a change of the configuration information;

a configuration management program for receiving a request from the configuration change control program to temporarily hold changing input-output requests and change configuration information; and

a second processor that executes the configuration management program, wherein contents of the configuration information table are updated by executing the configuration management program by the second processor.

11. (Original): A virtualization apparatus according to claim 10, wherein the first processor and the second processor are comprised of the same processor.

12. (Original): A virtualization apparatus according to claim 9, wherein the configuration change control program further comprises means for performing arbitration processing to limit the first processor that executes the respective means of the configuration change control program.

13. (Original): A virtualization apparatus according to claim 10, wherein the configuration information table comprised of a plurality of faces is prepared and a table of each face is switched.

14. (Previously presented): A virtualization apparatus according to claims 9, further comprising:
when changing a configuration from a first storage area to which the virtual volume corresponds to a second storage area,
a copy processing program for copying and processing data to the second storage area; and
a copy progress table that manages a progress status of the copy processing of the data using the copy processing program.

15. (Currently amended): A storage device comprising a plurality of storage areas for providing a real storage area and a virtualization apparatus that allocates the storage areas, forms a plurality of virtual volumes, and processes input-output requests from a plurality of host processors to one of the virtual volumes, wherein the virtualization apparatus includes:
means for requesting an input-output temporary hold to a first virtualization apparatus before changing a configuration of associating the virtual volume with the storage area that becomes a real area of the storage device;
means for allowing the first virtualization apparatus that received the request to complete all input-output requests received from the host processors that are being processed, shifting to a state of temporarily holding subsequently received input-output requests from the host processors, and returning a completion report;

means for instructing an allocation change of the storage area in regard to the virtual volume to the first virtualization apparatus when receiving the completion report from the first virtualization apparatus;

means for receiving the completion report of the allocation change from the first virtualization apparatus; and

means for sending an instruction to the first virtualization apparatus for releasing the input-output request that are being temporarily held,

wherein if the first virtualization apparatus does not send the completion report of the input-output processing, then the first virtualization apparatus is removed from a control range and the allocation of its storage area is not changed.

16. (Original): A storage device according to claim 15, wherein there are provided a configuration change control program for realizing each of the above means and a processor that executes the program.

17. (Previously presented): A storage device according to claim 15, wherein there is provided a copy control unit for copying data from storage areas originally allocated to a virtual volume to other storage areas that are subsequently allocated to the virtual volume.

18. (Previously presented): A change method for allocation of a storage area of a storage device to a virtual volume in a plurality of virtualization apparatuses that process input-output from a plurality of host processors to the virtual volume, comprising the steps of:
issuing, to the plurality of virtualization apparatuses, a request for temporarily holding input-output requests received from the host processors after a certain point of time;
making the respective virtualization apparatuses change the allocation of the storage area on the condition that a report indicating completion of the processing of all input-output requests is received from the respective virtualization apparatuses; and

9 releasing input-output requests that are being temporarily held after the
10 completion report of the allocation change is received from the respective virtualization
11 apparatuses,

12 wherein a virtualization apparatus that does not send the completion report of the
13 input-output processing is removed from a control range and the allocation of its storage area is
14 not changed.

1 19. (Original): A change method according to claim 18, wherein the step of
2 inputting an instruction of a configuration change from a management console is included and
3 the request for temporarily holding the input-output is issued in accordance with the input
4 instruction.

1 20. (Previously presented): A program for a configuration change that
2 changes allocation of a storage area of a storage device to a virtual volume in a storage system
3 including a plurality of virtualization apparatuses that allocate the storage area, form a plurality
4 of virtual volumes, and process input-output from a host processor to one of the virtual volumes,
5 comprising:

6 means for issuing, to the plurality of virtualization apparatuses, a request for
7 completing all input-output requests received from the host processors that are being processed
8 by the virtualization apparatuses and temporarily holding any subsequently received input-output
9 requests received from the host processors;

10 means for receiving, from the plurality of virtualization apparatuses, a report
11 indicating completion of the processing of the input-output request in response to the request for
12 completing;

13 means for instructing the allocation change of the storage area of the storage
14 device to all the virtualization apparatuses when receiving the completion report from all the
15 virtualization apparatuses to which the request was issued;

16 means for receiving the completion report of the allocation change from all the
17 virtualization apparatuses; and

18 means for sending an instruction to all the virtualization apparatuses for releasing
19 the input-output request that are being temporarily held,
20 wherein a virtualization apparatus that does not send the completion report of the
21 input-output processing is removed from a control range and the allocation of its storage area is
22 not changed.